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tension and resistance of the vocal ligaments, and on the pressure of the column of air in the trachea.

3. The grave tones vary directly, and the acute tones inversely, as the vibrating length and tension of the vocal ligaments.

4. The vocal tube is adjusted to vibrate with the glottis by the combined influence of its variations of length and of tension.

5. The elevation of the larynx shortens the vocal tube; and its depression produces the contrary effect. The diameter and extension of the tube vary reciprocally with the length.

6. The falsetto tones are produced by a nodal division of the column of air, together with the vocal tube, into vibrating lengths.

7. The pitch of the vocal organs, when in a state of rest, is, in general, the octave of their fundamental note.

The paper is illustrated by several drawings.

8. "Du Son et de l'Electricité." Anonymous, with the signature of *Hermes*. Being a Prize Essay for the Royal Medal.

This paper contains the account of a great number of facts and observations, collected from various sources, on the subject of the relations subsisting between electricity, the production of sound, the crystallization of bodies, the transmission of heat, the emission of light, and various atmospheric changes; from the consideration of which the general conclusion is drawn that all these phenomena are perhaps the results of the undulations of some ponderable material.

9. "Physiological Remarks on several Muscles of the Upper Extremity." By F. O. Ward, Esq., Medical Student at King's College, London. Communicated by P. M. Roget, M.D., Sec. R.S.

There is a remarkable fold in the tendon of the pectoralis major muscle, described by all anatomists, but the purpose of which has never yet, as the author believes, been explained. The muscle itself consists of two portions, one smaller and upper, arising from the clavicle, and passing downwards and outwards to an insertion in the humerus at a greater distance from the shoulder-joint than the place where the tendon of the larger and lower portion of the muscle, which arises from the sternum and ribs, and has a general direction upwards and outwards, terminates. Thus the respective portions of tendon belonging to the two divisions of the muscle are found to cross each other; the margin of that proceeding from the lower division passing behind, and appearing above that which proceeds from the upper fibres of the muscle. The forces exerted by each portion of the muscle being thus applied to parts of the bone at different distances from the fulcrum, act with different mechanical powers; which the author finds in every case to correspond exactly with the variations in the effects required to be produced, under different circumstances, by these muscular actions. Those muscular fibres, the tendon of which is inserted nearest to the centre of motion, and which consequently act by a shorter lever, are adapted to motions requiring a less force, but a greater velocity: and such is precisely the mechanical condition of the lower portion of the pectoralis major, which is employed more

especially in bringing down the arm, when previously raised, as in striking with the hammer, pickaxe, &c., where velocity is chiefly required, the weight of the instrument held in the hand sufficiently supplying the diminution of force. On the contrary, the lever by which the upper portion of the same muscle is enabled to act being, from the more distant insertion of its tendon, of greater length, is calculated to procure force at the expense of velocity, and is therefore peculiarly fitted for the performance of those actions by which the arm is elevated and weights raised; these being precisely the actions in which such muscles are employed. Adverting, also, to the respective obliquities in the direction of their action, the author traces the same express correspondence between the mechanism employed and the purpose contemplated. He pursues the same line of argument and obtains the same results in extending the inquiry to the structure and uses of those muscles, such as the coraco-brachialis, and the anterior fibres of the deltoid, which cooperate with the upper division of the pectoralis major; and the *teres major* and *latissimus dorsi*, which combine their actions with that of the lower division of the pectoral muscle.

This diversified adaptation of parts, he observes, forms the chief characteristic of the mechanism of Nature. Operating with unlimited means, she yet works with scrupulous economy; in all her structures no power is redundant, nor a single advantage lost: so that, however completely an arrangement may be subservient to one primary purpose, we find, on renewed examination, an equally accurate adjustment to various secondary and no less important ends.

The author then proceeds to inquire into the methods employed for determining the absolute and relative strength of muscles; and proposes, for that purpose, the application of the constant and equable stream of galvanism afforded by the new battery invented by Mr. Daniell.

10. "An Experimental Inquiry into what takes place during the Vinous, the Acetous, and different Putrefactive Fermentations of dissolved Vegetable Matter; and an Examination of some of the Products." By Robert Rigg, Esq. Communicated by P. M. Roget, M.D., Sec. R.S.

The author describes with great minuteness a long train of experiments on the subjects announced in the title of the paper. His first object of inquiry is into the nature of the changes which take place during the vinous fermentation; and the conclusion to which he arrives is, that in the formation of the products resulting from this process sugar is not the only vegetable principle which is decomposed, but that the changes consist in the combination of two equivalents of carbon, derived from the sugar of the malt, or other vegetable matter, ( $= 12.24$ ) with two equivalents of hydrogen from water ( $= 2$ ) forming  $14.24$  parts of olefiant gas: and in the combination of one equivalent of the carbon from the sugar, &c. ( $= 6.12$ ) with two equivalents of oxygen from water, ( $= 16$ ) forming  $22.12$  parts of carbonic acid. He thinks that, on this change taking place, the olefiant